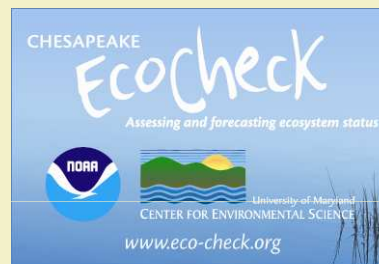# Principles of Effective Science Communication

Ben Longstaff

South Carolina Science Communication Course
April 7-11, 2008

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

CHESAPEAKE
EcoCheck
Assessing and forecasting ecosystem status
CENTER FOR ENVIRONMENTAL SCIENCE
www.eco-check.org

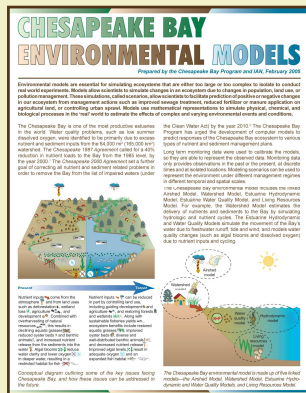Integration &
Application
Network
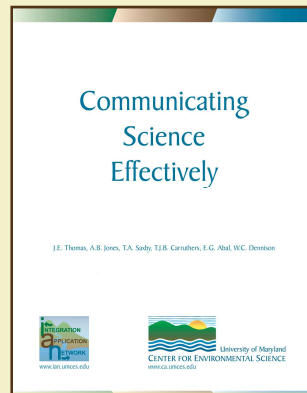
integration   application   network
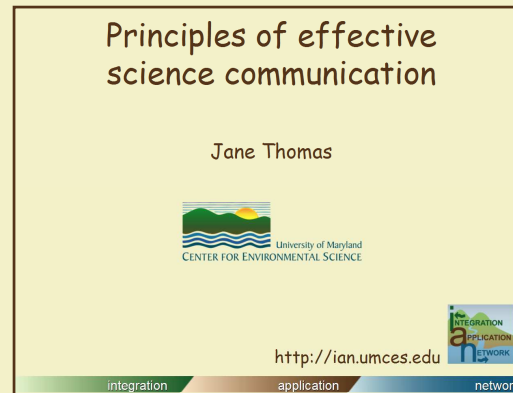
Develop a consistent style and format

- *Within* products, and also *between* products
  - Newsletters, presentations, websites, books
- Train your audience
- Use *Master Slide* or *Master Page* functions to ensure consistency
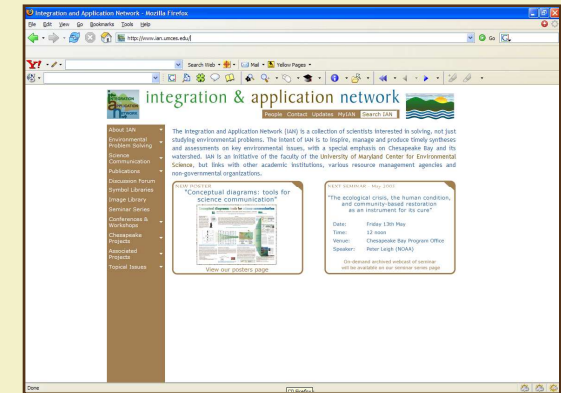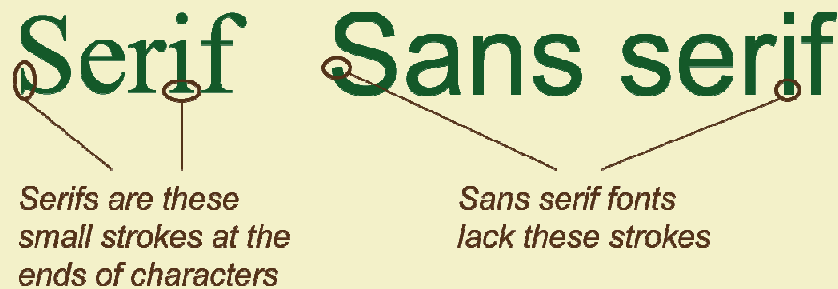
Newsletter   Book   Presentation   Website

Typography is the art of words

- Spelling and grammar
- There are two types of fonts – serif, and sans serif

Serif   Sans serif

Serifs are these small strokes at the ends of characters

Sans serif fonts lack these strokes

Serif fonts	Sans serif fonts
Times New Roman	Arial
Garamond	Century Gothic
Palatino	Helvetica

This is a serif font. Which of these fonts is easier to read?

This is a sans serif font. Which of these fonts is easier to read?

- Sans serif fonts are more readable from a distance

Typography is the art of words

- Text justification depends on layout, how much text you have, and medium (presentation, book, etc)

Fully justified text is lined up on both the left and right margins, but with different spacing between words. You can fit more text in fully justified paragraphs, however it can make the document look more crowded.

Flush left-ragged right justification has uneven spacing on the ends of the lines on the right margin, but keeps the spacing between the words the same. Flush left-ragged right justification does not look as tidy as fully justified text, but it adds white space at the ends of each line, which can make the overall document look less crowded.

There are no hard and fast rules about which kind of justification to use. It depends on the overall layout of your document, your audience, how crowded or sparse the text is, and the fonts and margins of the document. Try experimenting with different kinds of justification and use what most effectively communicates your message.

For small amounts of text or short, narrow lines, use flush left-ragged right justification, otherwise the different spacing between words becomes very noticeable and impedes easy reading by creating rivers of white space running down the lines. These rivers of white space can be minimized by using your software's preferences to set the maximum and minimum spacing between words.

Having narrow columns of fully justified text creates unsightly rivers of white space.

Use color, but use it judiciously

- Use color judiciously, especially red and green
- Contrast between your background, and text/graphics is important
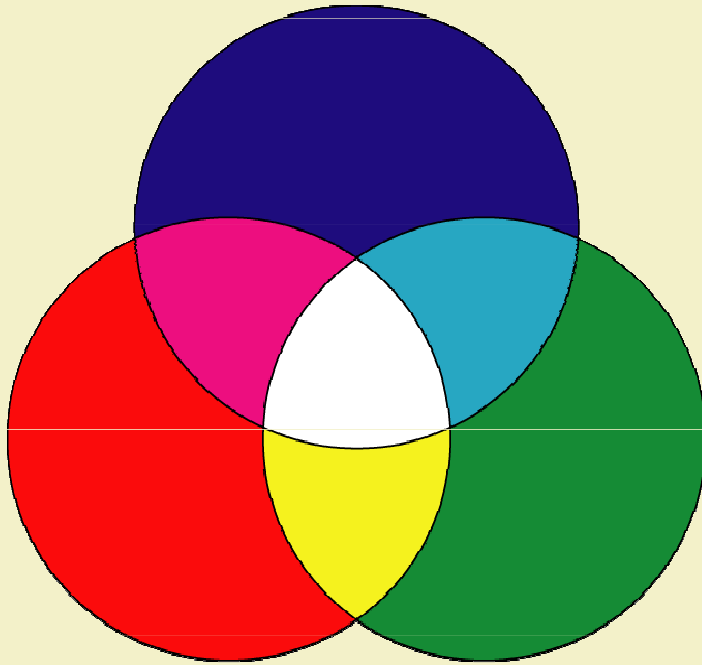- Improper use of color can alienate your audience

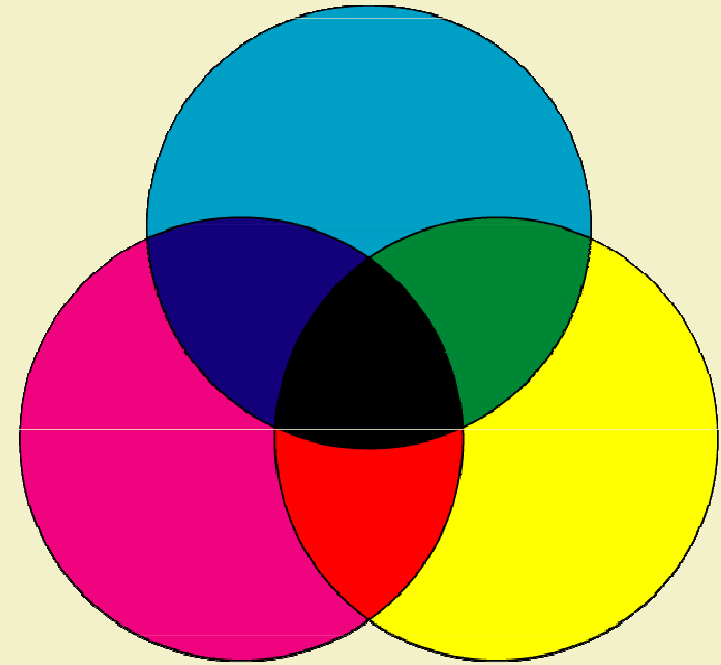| Brown	Dark blue
Dark green	Black

RGB vs. CMYK

- Red, Green, Blue
- Transmitted light (presentations, websites)
- Mixing the colors results in white light
- Absence of color results in black

- Cyan, Magenta, Yellow, blacK
- Printed ink (posters, newsletters)
- Mixing the colors results in black ink
- Absence of color results in white (or the background color)

Use the right resolution

- Resolution differs between different media
  - Printed products need 300 DPI
  - Presentations and websites need 96 DPI
- Using the right resolution for your communication will ensure your graphics are clear, and will also help with managing file size

Image types and formats

- *Raster/bitmap graphics* (photos, scans; resolution-dependent)
  - TIFF   CMYK or RGB; large file size due to lossless compression
  - JPEG CMYK or RGB; small file size due to lossy compression
  - GIF   RGB; small file size due to less colors; use on websites; transparency
  - PNG   RGB; relatively new format; transparency
  - EPS   CMYK or RGB; usually just for spot color images
- *Vector graphics* (created using software; resolution-independent)
  - EPS   CMYK or RGB; maintains resolution independence

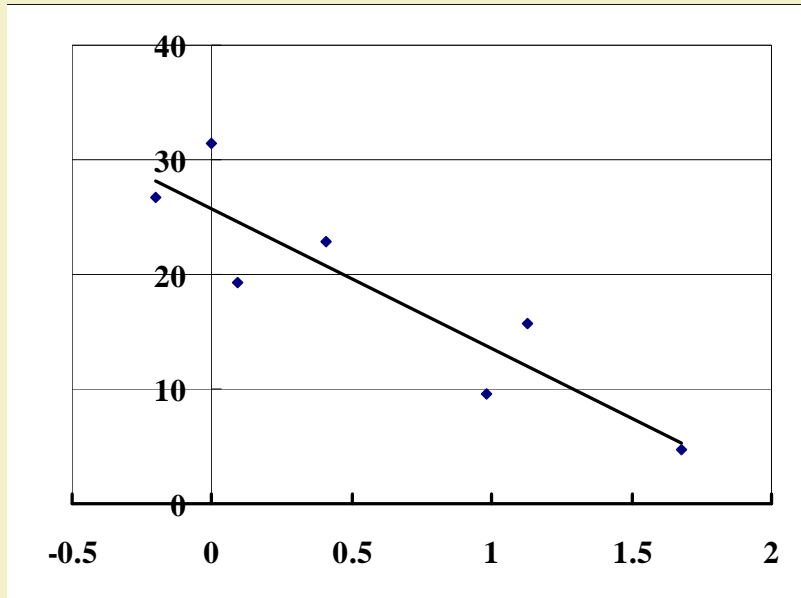| Bitmap image | Vector image | JPEG, TIFF or EPS bitmap image | GIF or PNG-8 bitmap image | PNG-24 bitmap image |

Image types and formats

| Destination	Resolution	Color format	Image format
Print	300 DPI	CMYK	EPS, TIFF, JPG
Screen	96 DPI	RGB	PNG, GIF, JPG

- It is worth the time and effort to create graphics for both printing and presentations
  - Optimize file size
  - Once you have the different formats, you can use them over and over again

Graph formatting makes all the difference

Bad (or no) formatting

Good formatting

$R^2 = 0.8115$
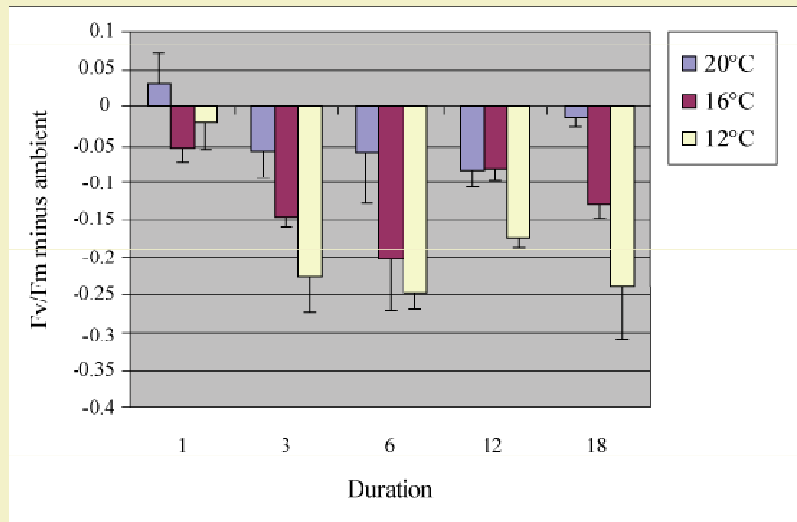
Total nitrogen (µM)

Seagrass depth range (m)
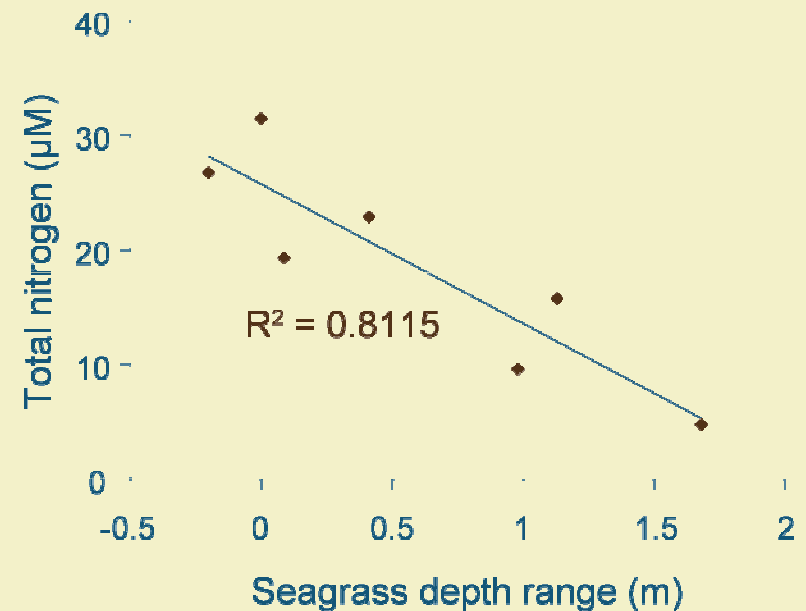
- Boxes, gridlines and white background are distracting – "chart junk"

- Axes not labelled, y-axis obscuring data

- Boring black and white

- Transparent background, no boxes or gridlines

- Large labelled axes with units at end
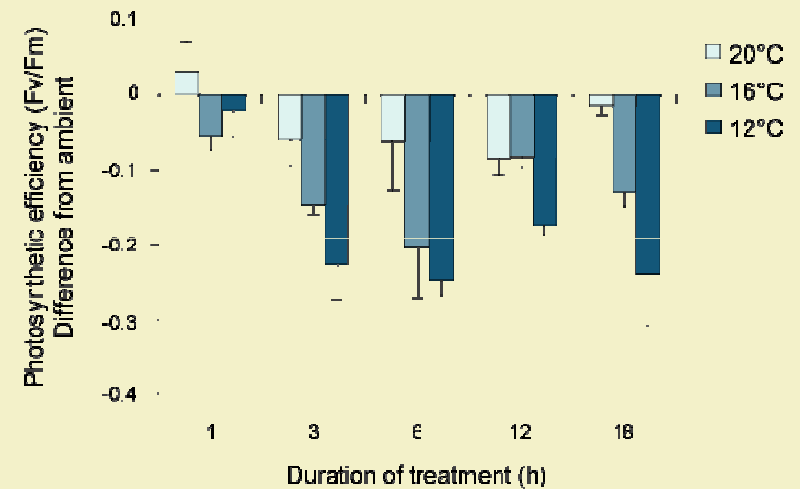
- Contrasting colors

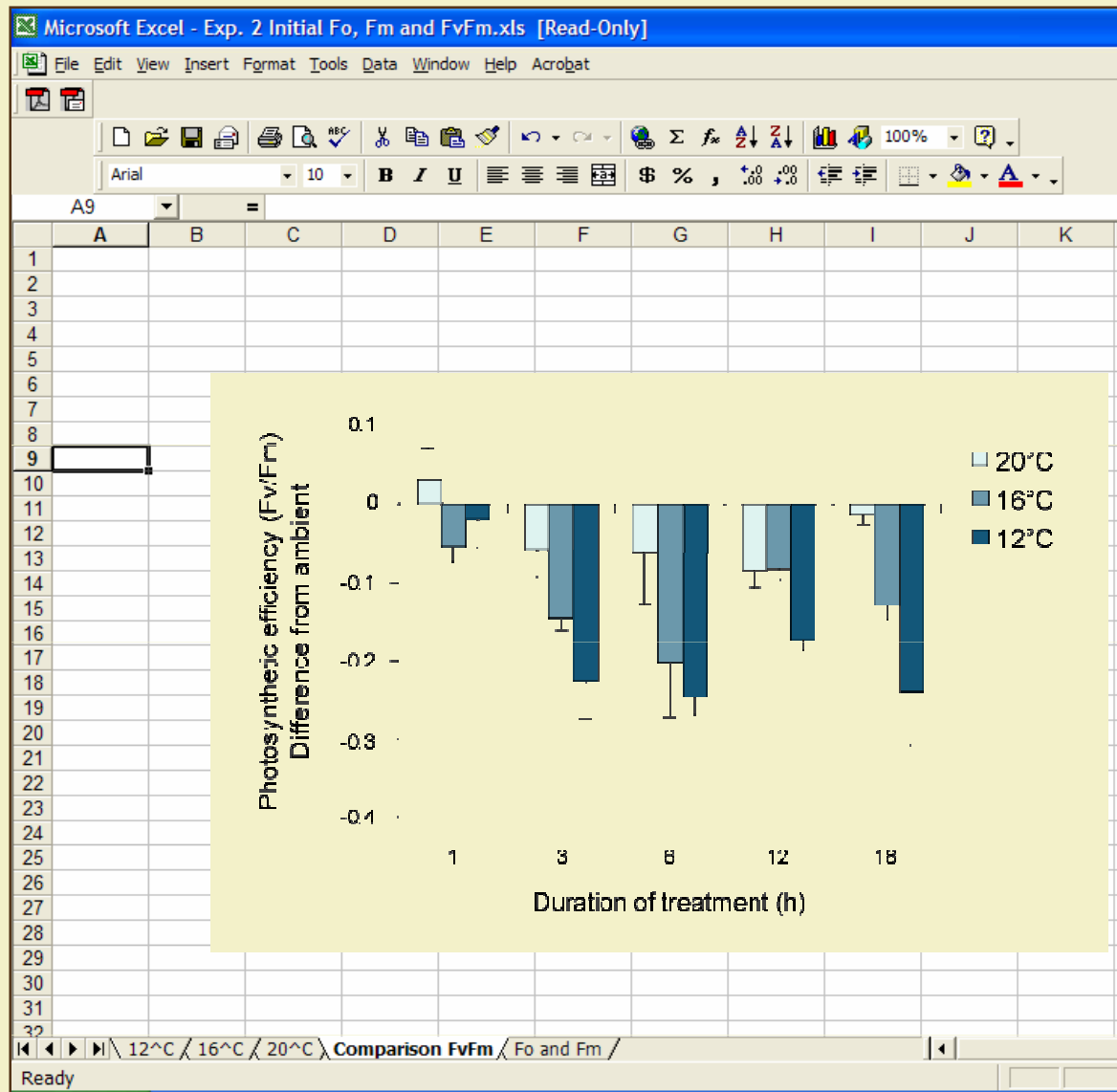# Graph formatting makes all the difference

Bad (or no) formatting

Good formatting

- Boxes, gridlines and white background distracting

- Axes label too technical, too many tick marks on y axis

- Excel default colors

- Transparent background, no boxes or gridlines

- Large, clearly-labeled axes, with units at end

- Contrasting colors

Get them right in data software first

- Use colored background box to facilitate color matching

- Remove graph background

- Remove grid lines, borders & unnecessary legends (i.e. if only one data series)

- Clean up extra tick marks and increase intervals between marks

- Label axis with title and units

- Select text and right click to format (subscript, etc)

- Delete colored background

Try to avoid tables ...

Region	EHI	Region area (km^2)	% area region	DO	Secchi	Chl a	TP	TN	$\delta^{15}N$
Upper Patuxent	0.21	21	13	0.66	0.00	0.34	0.00	0.09	0.15
Middle Patuxent	0.52	61	37	0.91	0.00	0.26	0.28	0.87	0.80
Lower Patuxent	0.48	53	32	0.99	0.00	0.37	0.18	0.47	0.85
Mouth Patuxent	0.58	30	18	1.00	0.00	0.38	0.93	0.53	0.62
Patuxent Overall	0.48	165	100	0.92	0.00	0.33	0.33	0.58	0.70
Upper Choptank	0.20	16	4	0.26	0.00	0.24	0.00	0.00	0.71
Middle Choptank	0.26	88	24	0.95	0.00	0.04	0.06	0.06	0.42
Lower Choptank	0.44	160	43	1.00	0.00	0.24	0.59	0.39	0.40
Mouth Choptank	0.49	109	29	1.00	0.00	0.62	0.53	0.38	0.42
Choptank Overall	0.40	373	100	0.96	0.00	0.30	0.42	0.30	0.43
Cape Charles City	0.75	N/A	N/A	nd	0.75	0.75	0.63	1.00	0.63

integration   application   network

... or format them right

Region	EHI	Region area (km²)	% area region	DO	Secchi	Chl *a*	TP	TN	δ¹⁵N
Upper Patuxent	0.21	21	13	0.66	0.00	0.34	0.00	0.09	0.15
Middle Patuxent	0.52	61	37	0.91	0.00	0.26	0.28	0.87	0.80
Lower Patuxent	0.48	53	32	0.99	0.00	0.37	0.18	0.47	0.85
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Lower Choptank	0.44	160	43	1.00	0.00	0.24	0.59	0.39	0.40
Mouth Choptank	0.49	109	29	1.00	0.00	0.62	0.53	0.38	0.42
Choptank Overall	0.40	373	100	0.96	0.00	0.30	0.42	0.30	0.43
Cape Charles City	0.75	N/A	N/A	nd	0.75	0.75	0.63	1.00	0.63

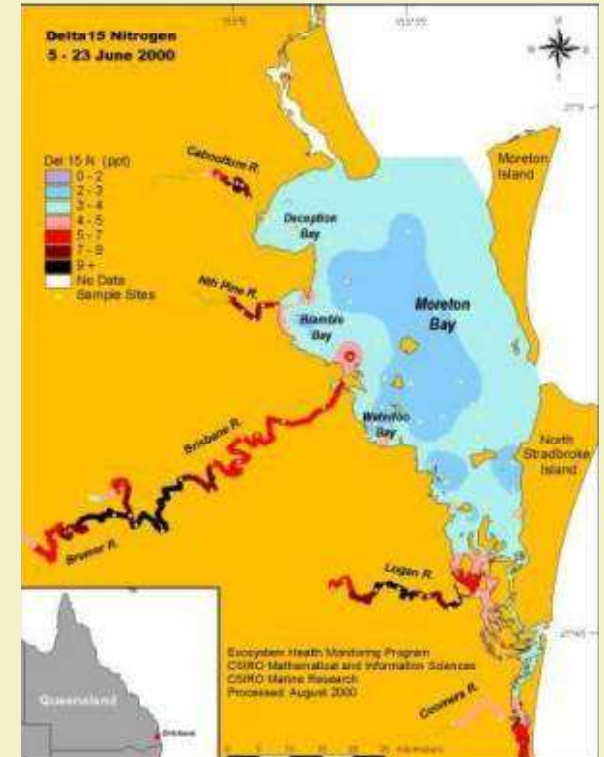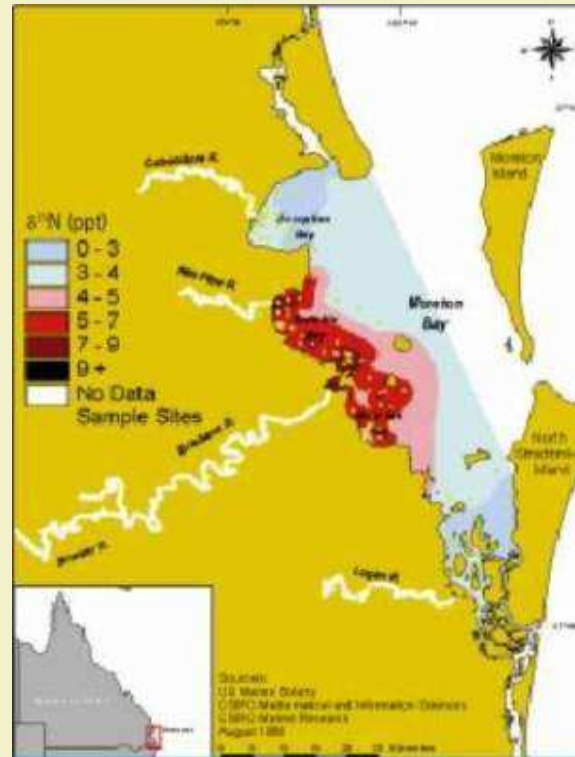- No vertical lines, minimize horizontal lines, use color and fonts to emphasize data

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Format maps to include more information
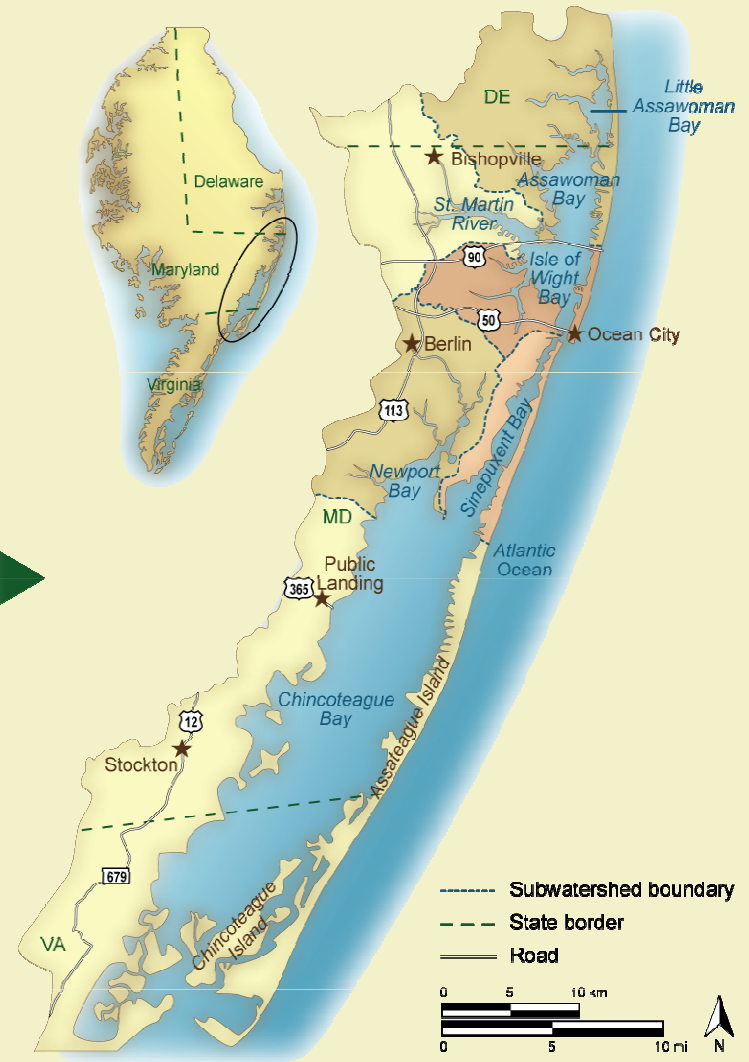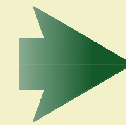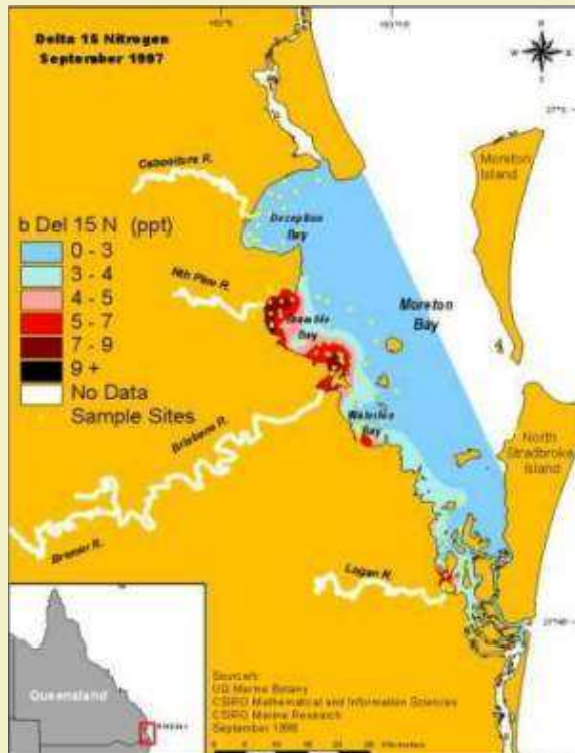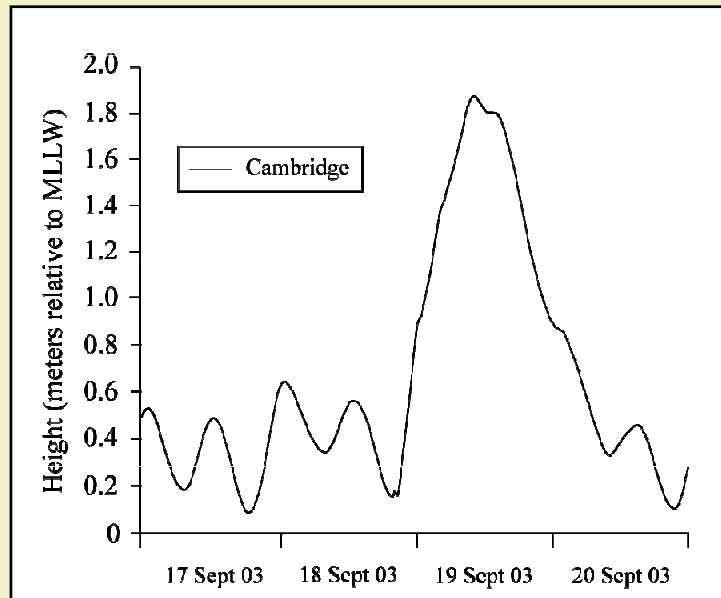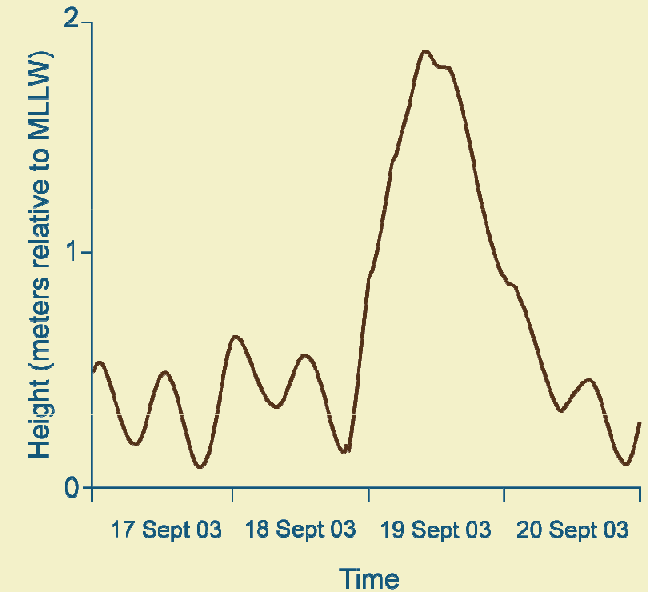
A map sequence can show temporal changes

- Improvements or degradation over time can be highlighted by a series of maps
- Consistent layout allows comparisons
- Maps should have scale and compass direction
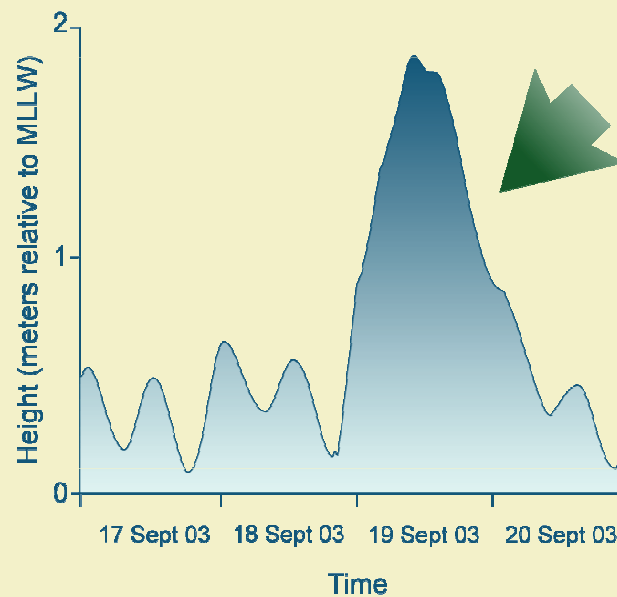- Maps should have a legend that is self contained & legible

Hurricane Isabel surge height

Default Excel

You + Excel

You + Illustrator

Cropping and annotation of photos can be very informative

Automatic cleaning unit

Light logger

Photos that are well chosen, cropped, aligned, distributed evenly and annotated provide information on methods, study site, description & relevance

Crop, align, and label photos carefully

vs

X ✓

Accurate cropping

Photos that are well chosen, cropped, aligned, distributed evenly and annotated provide information on methods, study site, description & relevance

X

✓

Pay attention to alignment & overlapping

Lyngbya induced dermatitis **X**

Lyngbya induced dermatitis **X**

Clear labeling of photos

Lyngbya induced dermatitis ✓

Lyngbya induced dermatitis ✓

Lyngbya induced dermatitis

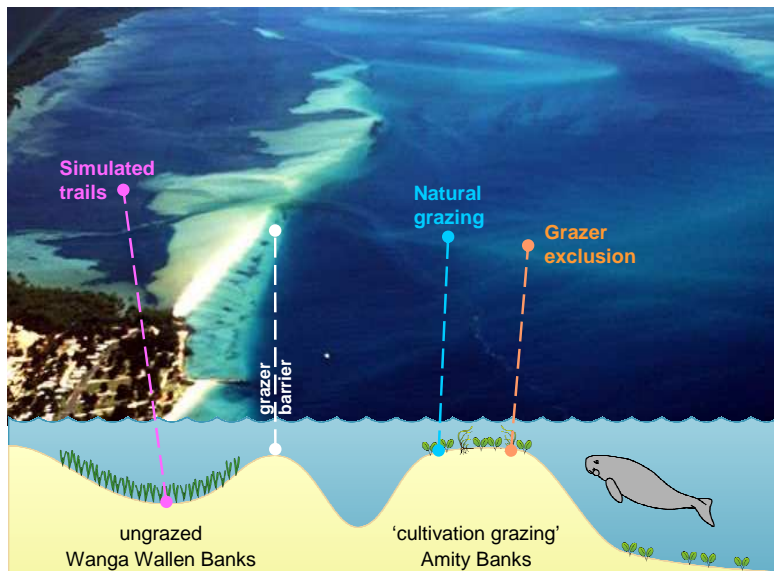Lesson: bad science communication = skin lesions

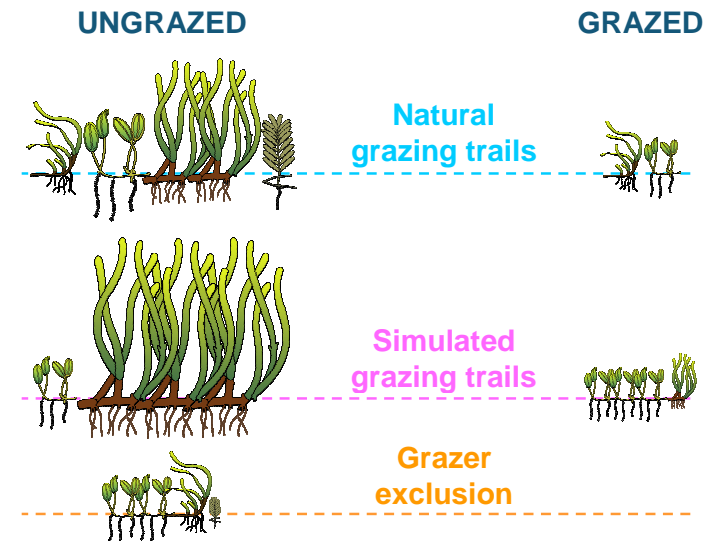integration   application   network

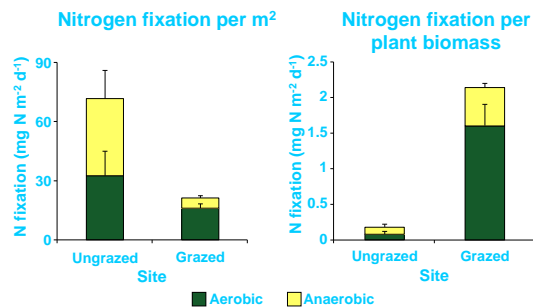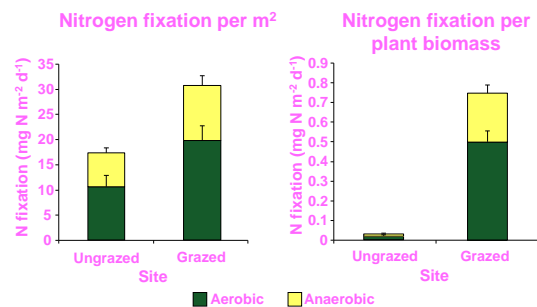# Combining all visual elements
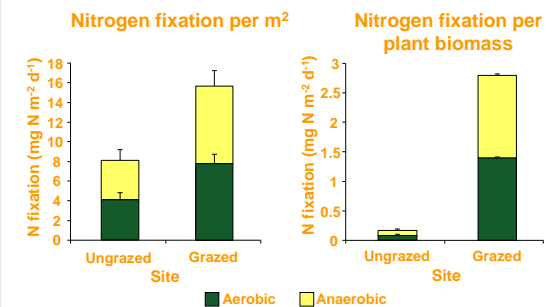
Site selection

Community composition & morphology

Nitrogen fixation
Natural grazing trails

Nitrogen fixation
Simulated grazing trails

Nitrogen fixation
Grazer exclusion

- Set up color pattern early on and train the audience

Principles of science communication

1. Provide synthesis, visualization & context
2. Relate to audience – provide big picture to local relevance
3. Simplify terms but not content
   (don't *dumb it down*, do *raise the bar*)
4. Use a key for unfamiliar visual elements.
5. Consistent *style* and *format for continuity*
6. Lose the jargon, dude
7. Define all unfamiliar terms,
8. Minimize AU (Acronym Use)
9. Engage audience: prepare for and invite questions
10. Use color, but use it judiciously

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